

Application No. 10/709,288
Technology Center 1775
Amendment dated February 7, 2007
Reply to Office Action dated September 7, 2006

REMARKS

Applicants wish to thank the Examiner for not making final the rejections of the claims.

In the Office Action, the Examiner reviewed claims 1-17 and 41-48 of the above-identified US Patent Application,¹ with the result that all of the claims were rejected. In response, Applicants have amended the claims as set forth above. More particularly:

Independent claims 1 and 11 have been amended to incorporate a limitation from claim 42 that requires at least an outer surface region (22) of the protective coating (20) is in a thermal treated state and contains sealed porosity formed by volatilization of a nonstoichiometric crystalline phase in the outer surface region (22). In addition to claim 42, support for this limitation can be found in Applicants' specification at paragraphs [0008] and [0035], where a second heat treatment is described as being performed to volatilize the nonstoichiometric crystalline phase and seal the resulting porosity.

Independent claim 11 has been further amended to recite that the outer surface region (22) consists essentially of the stoichiometric crystalline celsian phase, and a second region (24) beneath the outer surface region (22)

¹ Claims 18-40 were previously canceled in response to a restriction requirement.

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consists essentially of the stoichiometric crystalline celsian phase of barium-strontium aluminosilicate and optionally a nonstoichiometric crystalline lamella phase of barium-strontium aluminosilicate that contains a substoichiometric amount of silica. Support for these limitations can be found in claims 1 and 6, as well as the discussion of the second heat treatment in Applicants' specification at paragraphs [0008] and [0035].

In view of the amendments to its parent claim 1, dependent claim 2 has been amended to recite that the substantially all of the protective coating (20) contains sealed porosity. Support for this limitation can be found in Applicants' specification at paragraphs [0008] and [0035].

In view of the amendments to its parent claim 11, dependent claim 16 has been amended to recite the same limitation as original claim 6.

In view of the amendments to their parent claims 1 and 11, dependent claims 17 and 42 have been canceled.

Applicants believe that the above amendments do not present new matter. Favorable reconsideration and allowance of remaining claims 1-16, 41, and 43-48 are respectfully requested in view of the above amendments and the following remarks.

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Rejections under 35 USC §103

Independent claims 1 and 11 and their remaining dependent claims 2-10, 12-16, 41, and 43-48 were rejected under 35 USC §103 as being unpatentable over U.S. Patent No. 6,410,148 to Eaton, Jr., et al. (Eaton '148) alone, U.S. Patent No. 6,254,935 to Eaton et al. (Eaton '935) alone, Eaton '935 in view of U.S. Patent No. 6,352,790 to Eaton et al. (Eaton '790), or Eaton '148 in view of U.S. Patent No. 6,299,988 to Wang et al. (Wang). Applicants respectfully request reconsideration of these rejections in view of the amendments presented above as well as the following comments.

Applicants' independent claims 1 and 11 recite a protective coating (20) that consists (essentially) of barium oxide, strontia, alumina, and silica, and incidental impurities so as to have a barium-strontium aluminosilicate (BSAS) composition. The protective coating (20) has an outer surface region (22) that consists essentially of one or more stoichiometric crystalline phases of BSAS and is substantially free (e.g., not more than ten volume percent) of a nonstoichiometric crystalline phase of BSAS that contains a substoichiometric amount of silica.

Furthermore, claims 1 and 11 as now amended require that at least the outer surface region (22) is in a thermal treated state and contains sealed

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porosity formed by volatilization of the nonstoichiometric crystalline phase in the outer surface region (22). According to Applicants' teachings at [0008], [0026]-[0028], and [0035], following a heat treatment disclosed by Eaton '148 to develop the stoichiometric crystalline celsian phase,² a second heat treatment is performed to volatilize the nonstoichiometric crystalline phase and seal the resultant porosity within at least the outer surface region (22). This second heat treatment is described as being performed at

a temperature sufficient to eliminate the second phase by intentional volatilization. A suitable heat treatment for this purpose is believed to be near but below the melting temperature (1414°C) of free silicon within the substrate or coating system. . . . In addition to heat treatments performed within a furnace, surface heat treatments can be performed by such methods as laser glazing or in-situ surface treatments performed with the plasma spray gun after coating deposition and with the powder feed turned off. An advantage of performing a surface treatment is the ability to locally heat the coating above the melting temperature of free silicon in the substrate beneath the coating.

Eaton '148 and Eaton '935 were cited for broadly disclosing BSAS compositions suitable for protective coatings, including ranges for barium oxide, strontia, alumina, and silica that encompass ranges for these constituents recited in Applicants' claims. Eaton '148 and Eaton '935 were also both cited

² This heat treatment, cited by the Examiner on pages 4 and 6 of the Office Action, is performed at "about 1250°C. for about 24 hours."

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as disclosing

heat treating the product after formation (column 5 lines 9-17). Because the prior art exemplifies the applicant's claimed composition in relation to the substrate intermediate layer and coating as well as the heat treating process used to create the absence of porosity as disclosed by the applicant, the claimed physical property relating to the porosity after heating is inherently present in the prior art.

Office Action at pages 4 and 6.

However, according to Applicants' teachings at [0026] and [0027] and Figure 2, the heat treatment disclosed by Eaton '148 and Eaton '935 does not volatilize the nonstoichiometric crystalline phase or seal porosity that would result from its volatilization. Instead, Applicants teach that both stoichiometric and nonstoichiometric crystalline phases are present after Eaton's heat treatment at 1250°C. According to Applicants' teachings at [0028] and [0029] and Figures 3-7, it is only after subjecting the heat treated coating to temperatures over a range of about 1200°C to 1600°C does volatilization of the nonstoichiometric crystalline phase occur, and according to Applicants' teachings at [0035] an additional heat treatment is required to volatilize the nonstoichiometric crystalline phase and then seal the resultant porosity. This second heat treatment is preferably near but below 1414°C unless it is selectively performed on only the outer surface region (22), in which case the temperature can be

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above 1414°C.

Neither Eaton '148 nor Eaton '935 disclose or suggest performing a second heat treatment on their BSAS coatings to volatilize nonstoichiometric phases and seal resultant porosity. Furthermore, Eaton '148 does not disclose any heat treatment above 1250°C, and though Eaton '935 states that the heat treatment intended to "develop the celsian phase" is performed "at a temperature of greater than or equal to about 1250°C for about 24 hours" (column 4, lines 28-30, column 5, lines 20-28), Eaton '935 does not teach or suggest that this heat treatment is performed at a temperature sufficient to volatilize nonstoichiometric phases and seal the resultant porosity. Therefore, Applicants believe that the coatings of Eaton '148 and Eaton '935 cannot be said to inherently contain sealed porosity as now required by each of Applicants' independent claims 1 and 11.

Applicants believe that Eaton '790 and Wang do not supplement the teachings of Eaton '148 and Eaton '935 in order to arrive at Applicants' invention. Therefore, Applicants respectfully request withdrawal of the rejections under 35 USC §103(a).

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Closing

In view of the above, Applicants believe that the claims define patentable novelty over all the references, alone or in combination, of record. It is therefore respectfully requested that this patent application be given favorable reconsideration.

Should the Examiner have any questions with respect to any matter now of record, Applicants' representative may be reached at (219) 462-4999.

Respectfully submitted,

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Attachment: Fee Transmittal sheet